The dielectric material forming the tube 14 is not particularly limited, but appropriate examples thereof are reinforced heat-resistant glass, quartz, and ceramic.

The loop antenna 15 and the coaxial cable 16 are accommodated in the tube 14 such that the loop antenna 15 comes first. The conductor piece 17 is disposed at a position slightly rearward of the loop antenna 15 such that a gap between the coaxial cable 16 and an inner surface of the tube 14. As a result, measuring error due to leakage of high-frequency power is avoided.

The measuring probe 12 is inserted and mounted from a through hole 1A provided in the wall of the chamber 1 such that a tip end of the measuring probe 12 is located in the chamber 1. An O-ring 1B is interposed between an outer peripheral surface of the measuring probe 12 and the through hole 1A of the chamber 1 so that vacuum leakage is not caused by placement of the measuring probe 12.

As shown in Fig. 3, the coaxial cable 16 is of a general coaxial structure in which fluoroplastic 16c is interposed between a core wire 16a and a shield wire 16b continuously surrounding the core wire 16a from its outside along the longitudinal direction. Cooling fluid such as air or nitrogen gas is forcibly sent into a gap between the tube 14 and the coaxial cable 16. As a result, measuring error which may be caused due to temperature rise of the tube 14 or the coaxial cable 16 is available. As sending means of the cooling fluid, the following structure can be employed. For example, a thin tube (not shown) is inserted into the gap between the tube 14 and the coaxial cable 16, and a tip end of the thin tube is positioned near the conductor piece 17. The cooling fluid is sent to a deep portion of the tube 14 through the thin tube to cool the measuring probe 12. The cooling fluid is not limited to gas such as air, and may be liquid such as water.

Further, as shown in Fig. 5, the loop antenna 15, the coaxial cable 16 and the

conductor piece 17 are moved forward and backward as one unit by pulling or pushing the coaxial cable 16 in the longitudinal direction of the tube 14, so that the position of the loop antenna 15 is varied along the longitudinal direction of the tube 14. That is, with this measuring probe 12, the length L between the tip end of the tube 14 and a tip end of the conductor piece 17 including the loop antenna 15 can easily be varied.

Next, a specific structure of the probe control section 13 will be explained. The probe control section 13 comprises a swept-frequency high-frequency oscillator 18, a directional coupler 19, an attenuator 20, and a filter 21. These elements are connected to the measuring probe 12 in the order shown in Fig. 1. The high-frequency oscillator 18 outputs high-frequency power for measuring plasma density information of about 10 mW at frequency of 100 kHz to 3 GHz while automatically conducting swept-frequency. The high-frequency power output from the high-frequency oscillator 18 is transmitted to the measuring probe 12 through the directional coupler 19, the attenuator 20, and the filter 21 in this order.

On the other hand, the high-frequency power for measuring the plasma density information is not always emitted from the loop antenna 15 and absorbed by the plasma load, and some of the high-frequency power is not absorbed by the plasma load and reflected and returned. The reflection amount of the high-frequency power which is not absorbed by the plasma load and returned is detected by the directional coupler 19, and sent to a power reflection coefficient frequency characteristic obtaining section 22. High-frequency power frequency which is output from the high-frequency oscillator 18 is also sent to the power reflection coefficient frequency characteristic obtaining section 22.

The filter 21 removes high-frequency power for exciting plasma which is mixed into the probe control section 13 through the antenna 15. The attenuator 20

adjusts the amount of high-frequency power to be sent to the measuring probe 12.

As shown in Fig. 4, the directional coupler 19 is of a coaxial structure comprising a core wire 19a and a shield wire 19b continuously surrounding the core wire 19a from its outside along the longitudinal direction. A short coupling line 19c is provided along the core wire 19a inside of the shield wire 19b. A side of the coupling line 19c closer to the high-frequency oscillator is grounded through a resistor 19d so that the high-frequency power reflection amount can be detected at the non-grounded side of the coupling line 19c.

The power reflection coefficient frequency characteristic obtaining section 22 obtains counter frequency variation of the high-frequency power reflection coefficient based on the high-frequency power and the detected reflection amount thereof, and outputs the detected result to a display monitor 23. The counter frequency variation of the high-frequency power reflection coefficient is displayed on a screen of the display monitor 23 as a graph. That is, in the power reflection coefficient frequency characteristic obtaining section 22, expression [detected reflection amount of high-frequency power / total output amount of high-frequency power (constant amount in this embodiment)] is calculated, and the high-frequency reflection coefficient is obtained, and the obtained reflection coefficient is plotted in correspondence with frequency which is varied from moment to moment, so that the counter frequency variation of the high-frequency power reflection coefficient is obtained.

When the reflection coefficient is largely reduced, this point is the absorption peak where strong high-frequency power absorption is caused due to the plasma density, and this absorption peak is plasma absorption frequency. Since there is a constant correlation between the plasma absorption frequency and the plasma density, effective plasma density information can be obtained. When the plasma absorption frequency is